

Let's Talk About Flinching

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Why?

Because whether we like it or not, flinching is almost a taboo topic in the world of goaltending. I mean, the basic premise of being a goaltender is you have to not only be willing to put up with getting hit by pucks, but actively put parts of your body in front of pucks sometimes moving fast enough to cause serious damage to those body parts if unprotected. This almost doesn't seem natural, and from an evolutionary perspective it's amazing that the genes that produce good goaltenders have survived this long and haven't been completely eliminated from the gene pool. We would assume that the people who ultimately *choose* to goal-tend voluntarily waved their natural human right to flinch on pucks headed their direction in order to fulfill their role on a team as the last line of defense where sacrificing their bodies is not just appreciated, but expected on a daily basis.

Herein lies the challenge. Goaltenders will inevitably find themselves in situations that cause them to flinch. Everyone is different and has a different threshold, perception, and past-experience that will influence their response to a given shot, but it's important to note that a stigma *does* exist surrounding a goaltender flinching. In my experience, goaltenders usually have no problem seeking advice for their post-play tactics, puck-handling, or rebound control, but I don't recall often being asked for advice on flinching despite seeing it happen fairly regularly. Maybe this is just due to goaltenders being unaware of themselves flinching, although it seems unlikely as goaltenders know when they're tracking pucks well, competing to stop shots, and executing a game plan, and they know when their eyes are closed and their body is rigid as is indicative of a flinch.

Every January, it's encouraging to see the hockey community being quite active in the #BellLetsTalk campaign to raising awareness and fighting the stigma associated with issues in mental health. It is not my intention whatsoever to invalidate the serious mental health issues such as anxiety or depression by including flinching in the same remove-the-stigma category, instead I view it as a way for us to practice mental health initiatives on a regular basis if we see a goaltender struggling with flinching and the corresponding embarrassment and shame about seeking advice. This article will be an introductory look at what the flinching response actually is and what it means from the perspective of human evolution, physical characteristics of a flinch, the two kinds of flinches applicable to goaltenders, situational variables enhancing or eliminating a flinch (an introduction to the *over-ride* theory), and some tangible tactics more in-depth than "just don't flinch" or "just watch the puck" to help goaltenders un-learn the flinching response.

Flinching is a healthy, adaptive response of the human nervous system

Every single person on this planet will instinctively flinch in some situations when they perceive a rapidly approaching threat [1]. Built in to the human nervous system is a *startle reflex*, which is a robust natural response to intense stimuli with abrupt onset [2], like a loud crack of thunder or a puck shot hard at the face. Some theories (e.g. looming) suggest we have a zone around our bodies with specific brain regions that function to maintain a margin of safety, and select and coordinate the proper defensive behavior when that zone is violated [3]. Other theorists even suggest that escape is the most urgent survival requirement for any animal, even more important

than eating or shelter [3]. The startle reflex or flinch involves several different brain regions and pathways but much of the research supports the involvement of a small almond-shaped brain structure called the amygdala, which has a major role in processing emotions, the one most related to goaltenders and flinching being fear (which will be discussed later in the article). Fear is a healthy, adaptive human state which prepares us to respond to a threatening situation, generally caused by a fairly obvious source and subsides shortly after the source is no longer a factor [2]. The defense of our bodies is a challenge taken on by our sensorimotor system, and served by reflexes such as the startle reflex (i.e. flinching). The research shows that our natural defensive systems place the priority on protecting certain parts of our body like the head and neck, and abdomen which contains essential organs [2]. We know that the defensive behavior used is flexible and greatly influenced by factors like emotions, environment, and context, which is extremely encouraging news for goaltenders who feel as though they may be over-responding to seemingly harmless shots by unnecessary flinching. In other words, there is a high likelihood that unnecessary flinching can be un-learned and over-ridden.

What happens during a flinch (or Startle response)?

In humans, the typical startle response is to bring the body in to a generalized defensive stance as rapidly as possible in order to protect the most vital organs [3]. The first stage of defense is associated with vigilance, but immobility, where we're primed to respond but not actually active in the response yet. The following should sound familiar when thinking about a goaltender flinching; The head draws down and the shoulders lift up to protect the neck, the eyes close, facial and skeletal muscles contract, and depending on the threat the arms pull inward to protect the abdomen. Secondary movements can include the hands coming up in order to protect the head, or a duck away from the direction of the threat. The most important movement during a flinch for goaltenders is what happens with the eyes. The very first thing that happens during a flinch is a blink and a squint that will actually be stronger to the side the puck is approaching from (although in most cases we would assume this to be simultaneous if facing and square to a shot). During this blink, there's actually a quick centering of the eyes as they also retract slightly back in to the head, which is likely due to rapid contraction of the extra-ocular muscles surrounding the eyes. This extra eye movement creates a significant wobble in the direction of the gaze as the eyes first move downward and toward the nose, then rotate out toward the center of the gaze. The most robust reflex of a flinch is the burst of activity of the muscle that surrounds the eye called the *orbicularis oculi*, which leads the squint and blink and happens almost immediately once we perceive a threat. The eyebrows also lower and the skin under the eye is raised, which again all contributes to protecting the eye from harm as the first stage of a defensive response. The big point here is that vision is all but eliminated during the first stage of a flinch, which is important to remember for later on in the article as we discuss the different points in a shot release that a flinch may occur. Other characteristics of a startle reflex is a heart-rate acceleration and overall contraction of skeletal muscles- think of the body's natural fight or flight response [3].

Not all flinches are the same

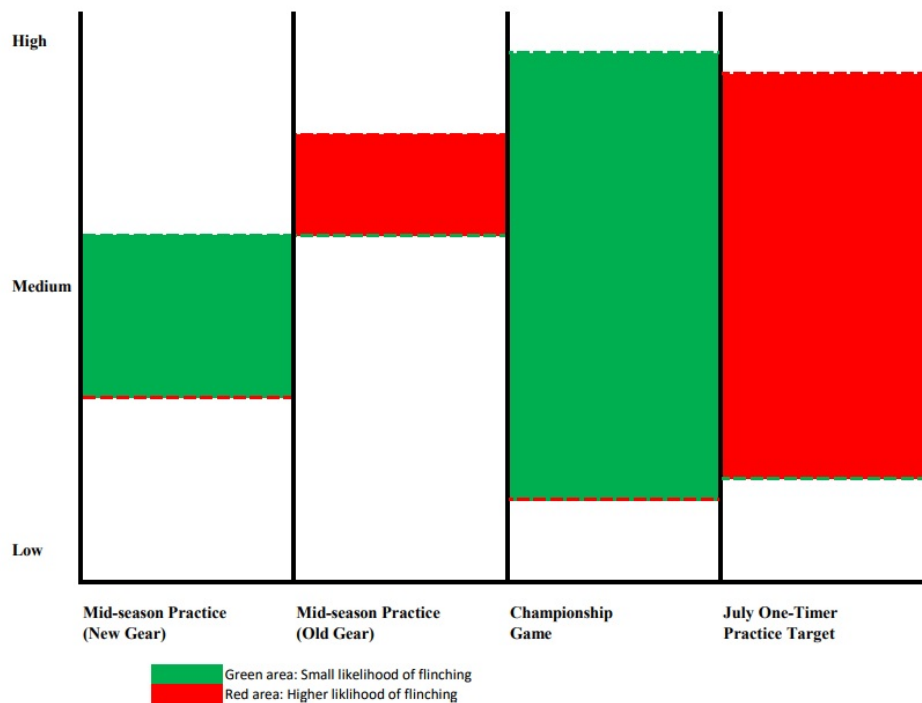
As stated above, there are some situations that will cause everyone to flinch at least to some degree. For example, a quick snap-shot from close range coming at the face is one of those situations where the startle response (i.e. flinch) will be elicited, and it is this type of flinch that we *aren't* worried about eliminating. This response is deeply engrained in our human biology, and to flinch when a puck is quickly approaching the face is to be expected. This is something we can call an "*unconditioned flinch*", meaning there's no learning involved with that type of flinch, it's something that will happen naturally as there's a real perceived potential for physical harm. The type of flinch that is the focus of this article is the "*conditioned flinch*", a flinch that goaltenders eventually *learn* to do after previous experience, on shots that wouldn't actually elicit an unconditioned flinch. Where an unconditioned flinch would start to occur is immediately *after* the puck has been released as it expands symmetrically in the goaltender's visual field at a high enough rate to signal danger, which then starts the cascade of the defensive reflex (eye squint and blink, shoulders shrug, head turns away, hands come up, etc.). The conditioned flinch actually begins just *before* or *just as* the puck is being released, when the goaltender perceives the shooter, wind-up, shot location, etc. as one that is likely to have a high potential for physical harm, so the response is to protect the body with the designated movements (eye squint and blink, shoulder shrug...) in preparation. The implications are numerous, starting with losing valuable information about the release off the stick as vision is greatly restricted during the squint and blink, and a general contraction of the skeletal muscles drawing the limbs inward as the body's natural response to protect vital organs. After the puck is travelling to the goaltender and the realization is made that it is not in fact on a direct collision course for the face or other vulnerable area, the disengagement is made from protection, and the save selection can actually begin. However, by this point it is usually too late, as the save itself is being executed with a huge delay from the time of the release.

The terms *conditioned* and *unconditioned* come from an early learning theory in psychology called classical conditioning developed by Ivan Pavlov. This name may sound familiar as it was the famous experiment he did with the ringing bell and salivating dog that demonstrated the concept. In short, classical conditioning is a way of learning about our environment. When a person naturally flinches at a rapidly approaching object or at a loud clap of thunder, no learning is required and we have what Pavlov called an Unconditioned response- the response occurs naturally. The stimulus, for example the thunder clap, is an Unconditioned stimulus, that which provokes a natural response. What Pavlov noticed was that these natural biological reflexes could be elicited with completely random, unrelated stimuli. After a number of trials, he successfully paired the ringing of the bell (conditioned stimulus) with the delivery of food (unconditioned stimulus) to the point where the bell alone was enough to cause the dogs to salivate (conditioned response), which would have been their natural response to the delivery of food [4]. For goaltenders, a shot coming hard and high (unconditioned stimulus) will often elicit a flinch, which is the natural, unconditioned response. The rapidly, symmetrically expanding puck in the goaltender's visual field acts as the threatening (unconditioned) stimulus to elicit the natural startle response (i.e. flinch). Again, this natural, unconditioned response is not the focus of this article, instead it's the conditioned flinch which often happens in the absence of any actual threat. Consider the situation during a team practice where the player with the heaviest shot walks in on a goaltender uncontested for a shot from the slot. The player takes a big wind-up, either for a slap-shot or pulls the puck back and loads up for what appears to be a high and hard wrist-shot. The combination of player + shot location + wind-up is now acting as the

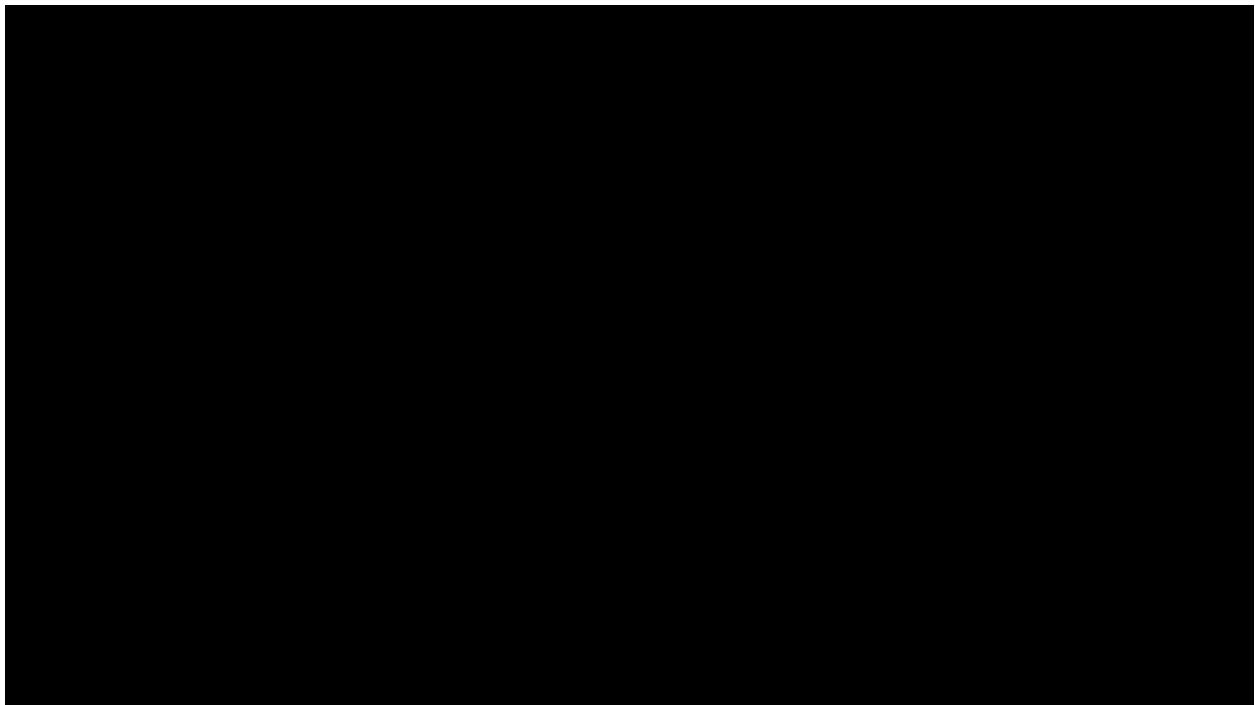
conditioned stimulus, because now only the potential for what's about to happen (largely based on what happened in the past) is being acted on and prioritized rather than an actual puck in motion. Thus, during the wind-up in this situation the goaltender may already be starting the flinch, which is in this case now a *conditioned* response to a *perceived predictor* of potential threat, rather than the actual threat itself. As noted above, the most robust response of a startle reflex (i.e. flinch) is the increased activity in the surrounding eye muscles [5], meaning that during the wind-up or release the squint and blink is now occurring, greatly reducing the valuable visual information about the shot release.

Over-ride Theory

With the focus on the conditioned flinch, let's examine how a goaltender's mindset and environmental factors can influence the frequency or amplitude of the flinch. A fairly common observation is that if a goaltender is going to flinch on a shot, it is most likely going to occur in practice or warm-up rather than a game. In other words, a situation with little consequence or meaning behind each particular shot, where the priority may actually be more toward self-protection rather than competition. Over-ride theory considers the interaction of two major factors that produce a high or low likelihood of flinching. The first factor is situational consequence, i.e. the external meaning behind each shot. Is it a warm-up shot in a mid-season practice, or is it a rebound in overtime for the league championship? The second factor is a goaltender's cognitive appraisal on a shot for perceived potential for physical harm. Is it a snap-shot from the smallest guy on your team from the point with no traffic, or is it a one-timer from Shea Weber from close-range with a hidden release? The following chart and video clip is an attempt to explain how the two factors interact to determine the likelihood of a goaltender flinching on a particular shot:



What this chart shows is the variability in responses from an individual goaltender, depending on the situation. Some goaltenders tend to flinch fairly regularly during a practice or game warm-up but less than an hour later during the game they're putting their head in front of shots. With this over-ride theory, I am theorizing that several factors are interacting to determine the response and that the prominence of one factor like meaning behind a shot can be enough to over-ride other variables like potential for physical threat. This is explained in more detail in the following video:



Link to video on YouTube:

<https://www.youtube.com/watch?v=HT52YarSEoE>

Symmetrical & Asymmetrical Expansion

Several references to symmetrical and asymmetrical expansion have been noted in this article, so the following will be a brief description of what those terms mean and how they relate to flinching. Think of watching a video of an object as it moves toward you. In relation to the frame, the object will appear to get bigger and bigger and take up more of the frame as it approaches the camera and as long as the path of the object is heading straight for the camera, it will expand symmetrically. On the other hand, asymmetrical expansion still provides the information that the object is approaching, but is not on a collision course with the eye/camera (i.e. facing a right-handed shooter, shooting to your top left). In some models of looming, symmetrical expansion is a sign of danger and depending on the rate of expansion, can trigger an evasive reaction such as flinching [3]. This is something that will continue to be researched for future articles as I have observed a higher frequency of goalies flinching when the shot is “across

the grain”, like a left-handed shooter aiming high glove (on a left-catching goalie) so my speculation is that the puck spends more time in this “looming zone” of the visual field and may appear to be expanding symmetrically, but is actually moving across the body. The asymmetrical expansion of the puck would also partly explain why goaltenders wouldn’t flinch on shots to the mid-line for a chest or stick save as the puck isn’t expanding at the same rate in the visual field to trigger the flinch response. For those wondering, the research suggests the threshold for a flinching response to a rapidly approaching object is object magnification beyond ~30 degrees of visual angle [6].

Reducing the Flinch Response

This last section will go over some strategies when working to overcome an overactive flinching response. Keep in mind that it’s not the shots at the head that we’re trying to eliminate flinching, instead it’s the conditioned flinch to a situation (i.e. a big wind-up) that a goaltender has learned to be threatening. The goal is to un-learn this response, and the research says it’s very possible.

Raise you green, lower your red

Think back to the over-ride theory video. A good place to start is to evaluate the quality of protection and check the equipment. Remember, ill-fitting, broken down gear is enough to raise the red line (perceived potential for physical threat) to the point where a goaltender starts flinching on what were once routine shots if the gear is failing to adequately protect. In conversation with some past professional and WHL goaltenders, the biggest factor that came up was the quality of the chest pad especially toward the end of the season as it starts to break down. The chest pad covers vital organs like the heart and lungs, so the body’s natural defence threshold is likely quite low when the confidence in the protection has dropped. When evaluating the gear, it’s always a good idea to add a plastic dangler to the mask, and to wear a padded undershirt and/or throat guard especially if the conditioned flinching is an issue. We can’t control where, or how hard the shots are going to come but we can control how well we’re protecting ourselves.

Raising your green line is a bit more abstract, but something I have noticed to work quite well. To refresh, the green line represents the situational consequence, or the meaning behind each shot. The situations with low meaning (i.e. mid-season morning practice) are the situations where conditioned flinching is more likely to occur because the red line is over-riding, and the goaltender is more worried about self-defence on shots rather than preventing a goal. Sometimes it’s as simple as applying more meaning to the shots, like having the goaltender imagine themselves in a game scenario or the shooters as a part of their rival team. Each goalie is different but the intrinsic meaning is typically much more robust than attempting to increase extrinsic meaning, like keeping score among teammates during a drill or putting something on the line, although it does help. It comes down to how much a goaltender is competing on a shot, and doing what is needed to raise that compete level during the low-consequence situations will provide several benefits, most notably getting the goaltender more comfortable in higher pressure situations, and treating practice shots like a game which greatly helps reduce the flinching response.

Find the Present

The link between anxiety and flinching (i.e. frequency and magnitude of the startle response) is known to be strong and persistent [7]. The implication for goaltenders is potentially a vicious cycle of elevated anxiety causing more flinches than should be occurring, and more flinches leading to higher levels of anxiety. This is something best dealt with through a professional such as a sport psychologist, but the big point to note is that the cycle must first be identified, accepted, then broken. Anxiety is about what we believe will happen in the future, and is evoked because people form exaggerated expectancies of the imminence, probability, and severity of a threat and underestimate their resources for coping [7]. The threat has not yet occurred but to the anxious goaltender, something bad is about to happen (e.g. getting hit up high with a hard shot) and the chance of being injured, at least as far as their cognitive appraisal, is much more likely. The resources for coping can be targeted by making sure the goaltender's gear is in good shape and they feel protected, as well as intentionally facing a few shots up high (start in a controlled setting like practice with a trusted and competent shooter). The goaltender must stay relaxed, while they get some practice with tracking a puck all the way in to get a glove on it or even take some off the mask. Sometimes all that is needed is a reminder that the mask will do its job to protect and the goaltender (despite some brief ringing in ears potentially) will be okay. Likewise, they have increased their resources to deal with a high shot by knowing they can get a glove on it.

A more advanced technique that a sport psychologist may introduce is a breathing exercise. Focusing on breathing is known to be a great way to bring someone back to the present moment as it's something we can 100% control, something we can focus on as it's happening, and something we can attend to and really experience in the moment. Even if flinching is not an issue, having some breathing exercises in your tool belt at-the-ready will be beneficial in those pressure-packed moments where a goaltender needs to bring themselves down to their optimal mental state.

Desensitize

The final tip discussed here to potentially help reduce the flinch is to desensitize the situation. What this means is to experience the situations as close to real-life as possible, but without the subsequent fear or consequence. In psychology, it's referred to as systematic desensitization, which is a technique used to eliminate things like phobias. Systematic desensitization is rooted in classical conditioning, except instead of learning to pair a random, unrelated stimulus with a natural response, we're looking to un-learn an existing pairing, such as starting to flinch on particular shooter, shot location, or wind-up. The formal process of systematic desensitization is something that should be facilitated by a professional psychologist, but the concept is a simple 3-step process that includes relaxation, creating a fear hierarchy (i.e. what's the least threatening shot up to the most threatening shot), and systematically working up the fear hierarchy while maintaining a certain relaxation state [8]. For goalies, this may be as simple as watching a video of pucks being shot at a camera or from behind the net, then to standing behind the glass or net as players shoot directly at you (introducing more sensory modalities now, the goalie can see, hear, even feel the shock of the puck hitting the net or glass). Essentially, they're experiencing more and more features of the flinch-inducing shots but without any of the previously associated consequences.

Summary

To summarize, there are some flinches that simply a natural part of human evolution and biology. While the unconditioned flinch will happen naturally as a puck is travelling toward the goaltender's head, the conditioned flinch will occur in anticipation of a puck shot to the head. The association between the puck and pain is assumed, rather than directly observed. The conditioned flinch is a learned association, with one of the first stages of the reflexive cascade being a strong blink and squint, which takes away valuable information about the trajectory of a shot as it's being released plus briefly puts the goaltender in a tense, defensive physical stance which they must disengage from before the save is actually executed. The environment and surrounding context play a huge role in the goaltender's cognitive appraisal of the potential physical threat behind each shot, the two main interacting factors being the situational consequence (i.e. meaning behind each shot), and the individuals perceived potential for physical threat. If the perceived potential for physical threat over-rides the situational consequence, likelihood of flinching is much higher than if the shot is more meaningful like in a championship game (think back to Marc-Andre Fleury in 2009 as he dove head-first to stop Nicklas Lidstrom with only seconds left to hang on to the lead and win the Stanley Cup. In that moment, I'm sure Fleury would have been happy to make that same save with no mask and wearing only a track-suit because the moment meant so much). Finally, just as a conditioned flinch is learned and often over-used in non-threatening situations, it can be un-learned as well. Goaltenders, parents, and coaches: if flinching is an issue, don't feel ashamed or embarrassed as fighting it only increases the emotional arousal and anxiety that is underlying the issue. Talk about it and work through it. Make sure you're protected and competing, and as always, thanks for reading.

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